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INNOVATIVE TRAINING PROGRAMS IN AVIATION MEDICINE

ABSTRACT

This paper will discuss several innovative aeromedical training programs for Aviation Medical Examiners (AMEs), civil aviation pilots, and others in the civil aviation community, offered by the FAA Civil Aeromedical Institute (CAMI). These training programs include: 1) Multimedia Aviation Medical Examiner Refresher Course (MAMERC), 2) Multimedia Clinical Aerospace Physiology Review for Aviation Medical Examiners Course (CAPAMEC), 3) Aviation Physiology Course, 4) Global Survival Course, 5) The FAA International Exchange Visitor Program

MULTIMEDIA AVIATION MEDICAL EXAMINER REFRESHER COURSE (MAMERC)

The Federal Aviation Administration has a voluntary force of approximately 6,000 physicians designated to perform duties as Aviation Medical Examiners (AMEs). These AMEs are located in the private sector, Federal agencies (Air Force, Navy, Army, NASA, Coast Guard, others) and in 86 countries around the world. AMEs are given authority to perform physical examinations of airmen (approximately 600,000) to determine their qualifications for the issuance of a medical certificate as required under Part 67 of the Code of Federal Regulations. In addition to providing an essential service to the aviation population, AMEs have the responsibility to ensure that only those applicants who are physically and mentally fit to perform flying duties safely will be issued medical certification. To properly discharge the duties associated with this responsibility, AMEs must have detailed knowledge and understanding of the FAA rules, regulations, policies, and procedures related to the medical standards and the certification process.

The MAMERC evaluates, instructs, and tests AMEs on their knowledge of medical certification standards and how they apply such knowledge to make appropriate aeromedical certification decisions. The MAMERC is a computer-based training course designed to evaluate and enhance the quality of airman medical certification decisions made by AMEs. For the first time in the history of the AME program a training course was designed to evaluate, instruct, and test AMEs on their medical decision-making skills regarding airmen fitness to fly. AMEs not only have to demonstrate their knowledge of medical certification standards, but how they apply such knowledge to make appropriate aeromedical certification decisions. The course provides pre-training testing of AME's proficiency in medical certification. Those AMEs who successfully complete the pre-test may reduce total training time to three or four hours. AMEs who are not as proficient are provided with a more detailed, self-paced, interactive instruction designed for maximum learning efficiency. Furthermore, the MAMERC provides an effective quality assurance/quality improvement tool for the Aeromedical Certification Program.

CLINICAL AEROSPACE PHYSIOLOGY REVIEW FOR AVIATION MEDICAL EXAMINERS COURSE (CAPAMEC)

This multimedia course was designed to enable AMEs to recognize the hazards of pilot exposure to self-imposed and environmental stress factors during the operation of an aircraft, that may lead to impairment, incapacitation, or death. This course familiarizes AMEs with the physiological effects resulting from the interaction between humans, the aerospace physical environment, and the aircraft. The objective of this course is to enable AMEs to recognize unsafe conditions and/or practices during the operation of an aircraft that may lead to the physiological impairment and/or incapacitation of pilots. AMEs must possess the necessary knowledge in aerospace physiology to provide appropriate advice to civil aviation pilots regarding the impact of these aviation-related stress factors.

AVIATION PHYSIOLOGY COURSE

Physiological training for pilots was introduced by the military in 1942 to prevent and/or reduce the number of incidents, accidents, and fatalities resulting from pilot exposure to the hostile environmental conditions encountered during flight.

Pilots who are knowledgeable about aeromedical facts are certainly better prepared to deal with unexpected and/or expected inflight events such as: 1) loss of cabin pressure (slow or rapid) leading to hypoxia, trapped gas problems, or decompression sickness, 2) exposure to an unfamiliar motion environment leading to spatial disorientation, 3) exposure to acceleration forces (Gs) leading to gray-out, black-out, or even unconsciousness (G-LOC), 4) exposure to noise, vibration, or thermal stress leading to impaired performance, and 5) exposure to self-imposed stresses which may lead to, and/or aggravate, any of the above mentioned inflight events.

The U.S. Code of Federal Regulations (CFR), Title 14, Part 61.31 (f)(2)(i), indicates that no person may act as pilot in command of a pressurized airplane that has a service ceiling or maximum operating altitude, whichever is lower, above 25,000 feet MSL unless that person has completed ground training that includes instruction on respiration; effects, symptoms, and causes of hypoxia and any other high altitude sicknesses; duration of consciousness without supplemental oxygen; effects of prolonged usage of supplemental oxygen; causes and effects of gas expansion and gas bubble formations; preventive measures for eliminating gas expansion, gas bubble formations, and high altitude sicknesses; physical phenomena and incidents of decompression; and any other physiological aspects of high altitude flight.

The objective of the FAA Aviation Physiology Course is to familiarize pilots with the physiological and psychological stresses of flight including the effects of self-imposed stress (illegal and legal drug use, alcohol consumption, smoking, fatigue, inadequate nutrition, sedentary lifestyle, excessive caffeine consumption, etc.) and their impact on aviation safety.

This course includes practical demonstrations of rapid decompression (8 to 18K feet), hypoxia (25K feet), and night vision, using the safest and most technologically advanced training altitude chamber (Fig. 1) available in the U.S. today.

Figure 1. Altitude Chamber

CAMI has the only operational altitude chambers (training and research) in the U.S. that meet the current safety standards in the pressure vessel industry to ensure the protection of occupants, operators, and maintenance staff. This requires that the design, fabrication, testing, and inspections of the chamber meet the following standards: 1) American Society of Mechanical Engineers, (ASME) ASME/ANSI, PVHO-1 "Safety Standards for Pressure Vessels for Human Occupancy", 2) ASME, "Boiler and Pressure Vessel Code". Section VIII, Division I, "Rules for Construction of Pressure Vessels", Section II, "Material Specifications", and Section IX, "Welding and Brazing Qualifications", 3) National Fire Protection Association, (NFPA), 70, National Electrical Code, (NEC) National Fire Protection Association, (NFPA), 99B, Hypobaric Facilities.

The Aviation Physiology Course also includes a practical demonstration of spatial disorientation using a General Aviation Spatial Disorientation Demonstrator (GYRO) or the Virtual Reality Spatial Disorientation Demonstrator (VRSDD). The critical importance of this type of practical demonstration is evidenced by aircraft accident investigation reports indicating that inflight spatial disorientation is a causal or contributing factor in about 10% of all general aviation accidents. Furthermore, it has been reported that up to 90% of the total number of general aviation accidents involving inflight spatial disorientation are fatal.

The GYRO (Fig. 12) is a device that provides 360 degree continuous yaw motion as well as + or - 15 degree pitch and 30 degree roll which, in conjunction with a computerized imaging system, results in a realistic simulation of flight.

Figure 2. GYRO

The GYRO provides civil aviation pilots, aviation medical examiners, and FAA flight crews with the opportunity to experience vestibular and visual illusions (spatial disorientation) that occur during IFR conditions in an inherently safe environment. The programmed flight in the GYRO does not require an instructor - only an external safety observer. The pilot receives a 2-min orientation and then takes the controls. The 6-min. flight progresses from VFR, with "out-the-window" scenes on a CRT, to IFR conditions.

The VRSDD (Fig. 3) is a one-of-a-kind prototype that uses a powerful computer with terrain and aircraft database and a Head Mounted Display (HMD).

Figure 3. VRSDD

This visual system is coupled with a 360 degree continuous yaw motion-platform and allows for a very realistic demonstration of the effects of spatial disorientation during flight. The key difference between the VRSDD and other spatial disorientation devices is that it immerses the pilot in a real time 3-dimensional space. The VRSDD utilizes high resolution 3-dimensional imagery to create a flight environment which is "virtually" real. The user has a real time interaction with the virtual environment by becoming part of it and by being able to manipulate/control it. Virtual reality is an effective, efficient, and inherently safe technology that can be used to simulate logistically impractical, expensive, or even dangerous real world settings (i.e., aviation and space environments, medical procedures, etc.).

The VRSDD is being used by civil aviation pilots, aviation medical examiners, and FAA flight crews participating in Aviation Physiology training courses offered at CAMI. It is also being used in support of the National Accident Prevention Program throughout the U.S. It provides civil aviation pilots with the opportunity to experience, in an inherently safe environment, certain vestibular illusions that occur during IFR conditions. The VRSDD provides a practical and highly convincing demonstration of the human limitations to maintain spatial orientation during IFR conditions, as well as emphasizing the importance of relying on cockpit instrumentation to safely fly under these conditions. This device provides the practical means to convince VFR rated pilots to stay out of IFR conditions, and increases awareness among IFR rated pilots that they are not impervious to the effects of spatial disorientation simply because they hold an IFR rating.

New multimedia courses on Aviation Physiology and on Aviation Human Factors for General Aviation Pilots are currently under development at CAMI.

GLOBAL SURVIVAL COURSE

The Global Survival Course provides the necessary knowledge and skills for coping with various common survival scenarios including desert, arctic, and water environments following an emergency aircraft landing, ditching, or a crash. Practice sessions are conducted using a thermal chamber, a ditching tank, and an emergency evacuation aircraft simulator. In addition, this course teaches how to easily assemble and use a personal survival kit.

The thermal chamber (Fig. 4) is used to practice survival techniques and procedures in a cold (-20°F), windy (15-20 mph), and dark (simulated night) environment.

Figure 4. Thermal Chamber

The ditching tank (Fig. 5) is used to practice techniques and procedures for emergency egress from a Cessna Sabreliner or a Beechcraft King Air; as well as water survival techniques, the use of flotation devices, and rescue procedures (using a helicopter hoist).

Figure 5. Ditching Tank

The emergency evacuation simulator (Fig. 6) consists of a section of fuselage of a passenger aircraft that is elevated (using hydraulic jacks) and then filled with non-toxic smoke (glycerin) to provide a practical and very realistic simulation of an emergency evacuation scenario due to smoke in the cabin. Trainees are required to evacuate the simulator using a conventional inflatable slide.

Figure 6. Emergency Evacuation Simulator

A new Multimedia Global Survival Course for Civil Aviation Pilots is currently under development at CAMI.

FAA INTERNATIONAL EXCHANGE VISITOR PROGRAM

The FAA Civil Aeromedical Institute supports international programs that promote interaction between aviation medicine professionals, enable exchange of scientific information, and promote FAA's leading role in civil aviation medicine worldwide.

One such program is the International Exchange Visitor Program which allows qualified specialists from foreign civil aviation organizations to enter the U.S. to conduct studies and/or exchange information and expertise at FAA facilities and at a minimum cost to the agency. The main objective of this

program is to promote global aviation safety through international cooperation activities, promotion of FAA policies and procedures and of U.S. standards and equipment, and avoidance of unnecessary duplication of research efforts.

Participants in this program: 1) learn the functions and responsibilities of the FAA Office of Aviation Medicine as they relate to the promotion of aviation safety, 2) participate in the day-to-day work activities at CAMI, 3) share their specialized knowledge and skills with FAA's specialists in support of various operational programs, and 4) receive the benefits of interacting with FAA professional and technical personnel at a leading civil aviation medicine institute.

For additional information about any of the above mentioned training programs and services please contact:

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